HYDROLOGY

Precipitation

The upper watershed areas have slightly more rainfall than the lower basin areas. The average annual rainfall at Union (lower watershed) was 39.63 inches over the period 1961-90 (Owenby and Ezell 1992). At Rolla (upper watershed) the average annual rainfall was 41.09 inches over the period 1961-90.

USGS Gaging Stations

Bourbeuse River watershed US Geological Survey (USGS) water discharge gage stations collect daily water discharge data, and also house National Weather Service gage-height meters (Figure 4). The following lists gage station location and period of record.

Gage Station	Stream	Location	Comment	Period of Record
High Gate, 07015720	Bourbeuse River	Lat. 38 08' 49", long. 91 34' 50" in T39N, R6W, Sec. SW, NE 4	located on downstream side of the right bridge pier on State Highway B.	July 1965 - present
Union, 07016500	Bourbeuse River	Lat. 38 26' 45", long. 90 59' 30" in T43N, R1W Sec. SE 26	located on the left streambank at the upstream side of the bridge on US Highway 50. Part of the ambient water quality monitoring network.	June 1921 - present
St. James, 07105000	Bourbeuse River	no longer active	no longer active	1977-79 & 1948-82
Rolla, 07015500	Lanes Fork	no longer active	no longer active	1952-71
Rosebud, 07015800	Langenburg Branch	no longer active	no longer active	1964-70
Spring Bluff, 07016000	Bourbeuse River	no longer active	no longer active	1966-82

Permanent and Intermittent Reaches

Several streams in the watershed are losing for many stream miles. Dry Fork has large segments that are considered losing (Figure 1; Location Section). Dry Creek in the Lower Bourbeuse River hydrologic unit loses flow to ground water for a major portion of its length. Recently, portions of Winsel Creek were designated as losing by the Department of Natural Resources.

The USGS defines perennial or permanent streams as those having water 12 months of the year during normal precipitation. Permanent and intermittent stream reaches within the Bourbeuse River watershed were tabulated from Funk (1968) using information derived from 7.5" topographic maps (Table 7). According to Funk, the Bourbeuse River watershed has 163 miles of permanent streams capable of supporting angling.

Average Annual Discharge

Of the two currently active gages, the volume of water that passes the High Gate gage station, (Figure 5) draining approximately 135 square miles, is less than that which passes the Union gage station, draining approximately 808 square miles. From the period of 1965-97, the annual mean discharge at the High Gate gage station (USGS 1997) was 138 cubic feet per second (CFS). Over the same period, the lowest annual mean was 21.7 CFS and the highest annual mean, 315 CFS. The annual mean at the Union gage station was 681 CFS for water years 1921-97. At this same gage, the highest annual mean was 1,771 CFS, and the lowest annual mean was 106 CFS.

Figure 5

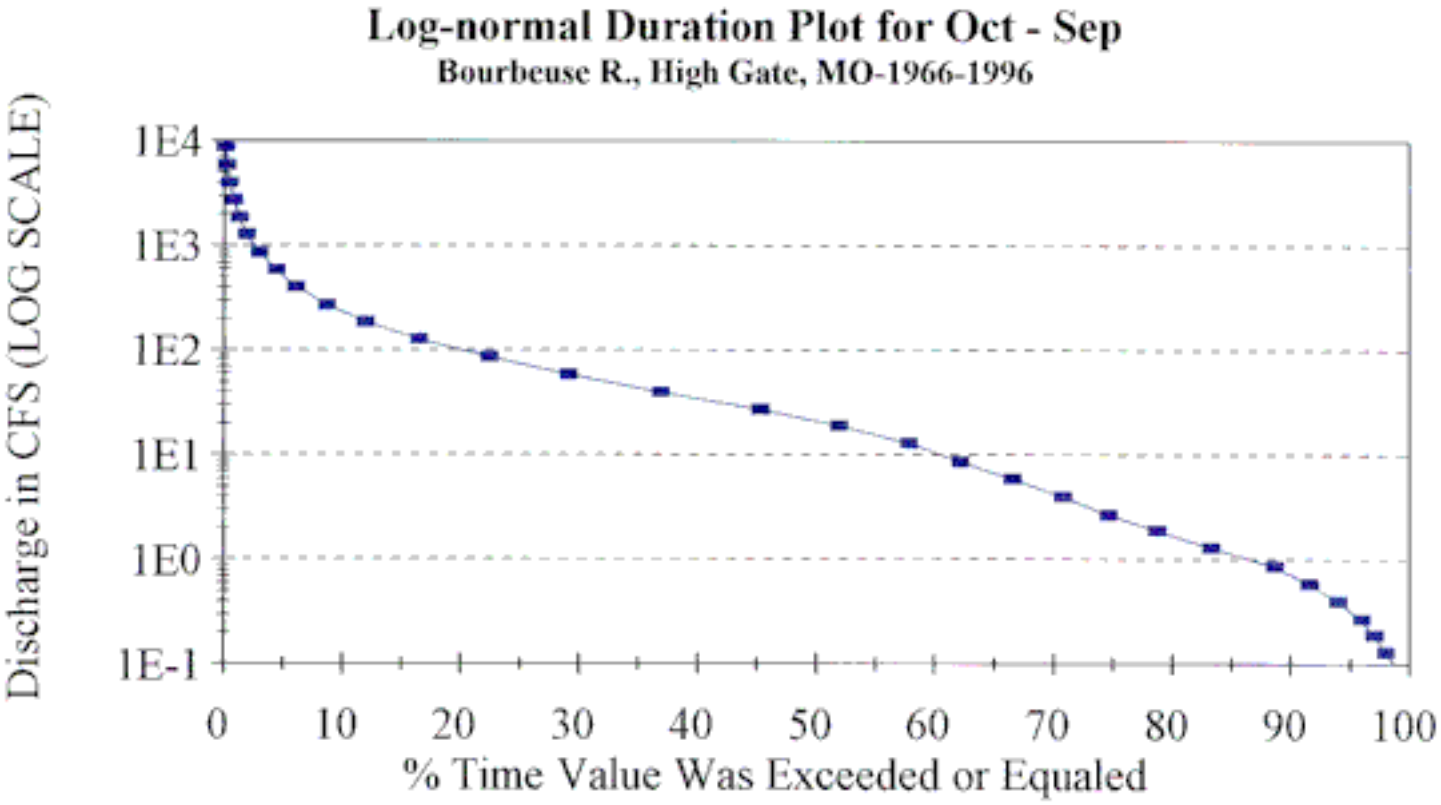
Log-normal Duration Plot for Oct - Sep
Bourbeuse R., High Gate, MO-1966-1996
Discharge in CFS (LOG SCALE)
1E4
1E3
1E2
1E1
1E0
1E-1
0
10
20
30
40
50
60
70
80
90
100
% Time Value Was Exceeded or Equaled

Table 7. Permanence of stream flow (fishable waters) in third-order and larger streams in the Bourbeuse River watershed (Funk 1968). Note: Dry reaches constitute the difference between total length of permanent streams and intermittent pools.

Stream Name	Order[1]	Permanent *Stream*[2]	Intermittent *Pools*[2]	Total Length Miles[3]
		Miles	Miles	
Bourbeuse River		106.5	11.5	147
Lower Bourbeuse Hydrologic Unit 100-002,001				
Birch Creek (Franklin)	3		4	7.90
Voss Creek (Franklin)	3		0.5	4.40
Spring, Boone, & Red Oak creeks Hydrologic Unit 090-007, 006, 005				
Spring Creek (Franklin)	4	3	3.5	14.90
Boone Creek (Crawford)	4	2.5	9.5	16.35
Little Boone Creek (Franklin)	3		1.5	6.10
Red Oak Creek (Gasconade-Franklin)	4	5.5	8	18.37
Kriete Creek (Franklin)	3		0.5	2.70
Soap Creek (Gasconade)	3		0.5	6.95
Little Bourbeuse River & Brush Creek Hydrologic Unit 090-003, 002				
Little Bourbeuse River (Crawford- Franklin)	4	11	3	20.40
Brush Creek (Crawford-Gasconade)	5	15.5	3	24.27
Prairie Creek (Crawford)	4	2.5	1.5	5.72
McDade Spring Lateral (Crawford)	3	1	1.5	4.35

Dry Fork Hydrologic Unit 040-002,001				
Dry Fork (Maries-Gasconade)	4	11.5	13	34.33
Brush Creek (Gasconade)	3		1	4.50
Lower Peavine Creek (Maries)	3		2	6.55
Upper Peavine Creek (Maries)	3		0.5	7.70
Middle Bourbeuse River Hydrologic Unit 090-008, 004, 001				
Big Creek (Franklin)	4		3	6.90
Price Creek (Gasconade)	3		2	6.15
Lanes Fork & Upper Bourbeuse River Hydrologic Unit 020-002, 003, 001				
Lane Fork (Maries-Phelps)	3		11.5	8.30
Pin Oak Branch (Maries)	3		0.5	5.12
Clear Creek (Phelps)	4		2	9.85

[1] Stream order taken from 7.5" topographic maps.

[2] Taken from Funk 1968.

[3] As determined using hand dividers from 7.5" topographic maps by East Central Regional and St. Louis Regional Fisheries personnel.

Table 8. Estimated magnitude and frequency of annual low flow within period of record listed except where footnoted (MDNR 1996, USGS 1997, Skelton 1970).

				DISCHARGE (CFS)			7-DAY LOW FLOW		
GAGE NO.	STREAM	SITE	PERIOD OF RECORD	Average	Maximum	Minimum	Q2	Q10	Q20
7015000	Bourbeuse	nr. St. James	1947-81	15.8			0.0[4]	0.0	
7015720	Bourbeuse	nr. High Gate	1965-97	138	315	21.7	0.1[3]	0.0	
7016000	Bourbeuse	nr. Spg. Bluff	1943-81				6.8	0.9	4.0[1]
7016500	Bourbeuse	@ Union	1921-97	681	1771	106	32[3]	18	27[2]
7015500	Lanes Fork	nr. Rolla	1953-72				0.0	0.0	

Period of Record - [1]1962-1965, [2]1922-1967, [3](USGS 1994), [4]1947-81

Water years 1993 and 1954 were the highest and lowest annual average flows on the Bourbeuse River, where the discharges averaged 1,771 CFS and 106 CFS, respectively. Peak record flow was on December 5, 1982, when flow was 73,300 CFS. The lowest flow occurred October 10, 1956, when flow was 11 CFS.

Stream/Hydrologic Characteristics

7-Day Q2, Q10, Q20 Low Flows

The 7-day Q2 low flow is the two-year return period of 7-day low flow. Every two years (Q2) the discharge at the Union gage station has fallen below 32 CFS for seven days, and every ten years the discharge has fallen below 18 CFS for seven days (Table 8). Farther upstream at Spring Bluff, every two years (Q2) the discharge has fallen below 6.8 CFS for seven days, and every ten years the discharge has fallen below 0.9 CFS for seven days.

In general, flows are sustained by adequate precipitation, evaporation, runoff conditions, and ground water supply (sandstone and cavernous carbonate rocks transfer water from highland areas to deep river valleys). The average annual runoff near Union, draining 808 square miles, is 11.9 inches/year (Vandike 1995).

The major difference between the Meramec River and the Bourbeuse River watersheds that affects low flow characteristics is the groundwater contribution to each stream. Numerous springs contribute to the Meramec River, where the Bourbeuse River has fewer springs with smaller discharges. Local geology is the underlying factor. Runoff rates are higher on the Bourbeuse than on the Meramec River (Vandike 1995).

Flow Duration Curve

A comparison of the flow-duration curve characteristics of the upper Meramec River and the Bourbeuse River show how groundwater affects these streams (Vandike 1995). At the Steelville gage station on the upper Meramec River, discharge is nearly three times that of the Bourbeuse River. Figure 5 shows the percentage of time that the flow equals or exceeds a given discharge. Represented in the figure in log normal scale, High Gate station discharge is 401 CFS for 6% of the time, 19 CFS for 52% of the time, and 0.35 CFS during 95% of the time.

A small percentage of the time the Bourbeuse River reaches flood stage. The two-year recurrence interval (probability of flood event or 50% of the time) at the Union gage station, the flow could reach 13,700 CFS (Hauth 1974) and at the 100-year recurrence interval (one percent chance in any given year), 34,300 CFS.

Dam and Hydropower Influences

There are no hydroelectric facilities in the Bourbeuse River watershed. A number of small recreational reservoirs are found throughout the watershed. Indian Lake is a 326-acre residential lake found in the Brush Creek hydrologic unit (Figure 1; watershed base map). Towell Lake at Little Prairie Conservation Area is a 100-acre public recreational fishing reservoir. Other small private lakes include Foxboro Lake (25 acres), Tea Lakes (0.5 acres, 5 acres, 0.25 acres, and 25 acres), and Melody Lake (35 acres).